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NASA-13854 (October 2003)  
NATIONAL AERONAUTICS NASA  
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DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13854

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10/03

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SECTION 13854

GAS DETECTION SYSTEMS  
10/03

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NOTE: Delete, revise, or add to the text in this  
section to cover project requirements. Notes are  
for designer information and will not appear in the  
final project specification.

This section covers equipment, performance, and  
testing of stationary electrical instruments used  
for sensing the presence of combustible gases, or  
the deficiency of oxygen, in ambient air.

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PART 1 GENERAL

1.1 REFERENCES

\*\*\*\*\*  
NOTE: The following references should not be  
manually edited except to add new references.  
References not used in the text will automatically  
be deleted from this section of the project  
specification.

\*\*\*\*\*

The publications listed below form a part of this section to the extent  
referenced:

COMPRESSED GAS ASSOCIATION (CGA)

CGA P-14 (1992) Accident Prevention in Oxygen-Rich  
and Oxygen-Deficient Atmospheres

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA 310-C (1992) Cabinets, Racks, Panels, and  
Associated Equipment

ISA - THE INSTRUMENTATION, SYSTEMS AND AUTOMATION SOCIETY (ISA)

ISA S12.13.01 (1986) Performance Requirements,  
Combustible Gas Detectors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 110 (1993) Emergency and Standby Power Systems  
NFPA 70 (2002) National Electrical Code  
NFPA 72 (1996) National Fire Alarm Code

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD 461 (Rev C) Electromagnetic Emission and  
Susceptibility Requirements for the  
Control of Electromagnetic Interference  
MIL-STD 462 (Rev D) Measurement of Electromagnetic  
Interference Characteristics

1.2 SUBMITTALS

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NOTE: Review submittal description (SD) definitions  
in Section 01330 SUBMITTAL PROCEDURES and edit the  
following list to reflect only the submittals  
required for the project. Submittals should be kept  
to the minimum required for adequate quality  
control. Include a columnar list of appropriate  
products and tests beneath each submittal  
description.

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The following shall be submitted in accordance with Section 01330 SUBMITTAL  
PROCEDURES in sufficient detail to show full compliance with the  
specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists shall be submitted in  
accordance with paragraph entitled, "General," of this section.

SD-02 Shop Drawings

The following shall be submitted in accordance with paragraph  
entitled, "General," of this section.

Connection Diagrams  
As-Built Drawings

SD-03 Product Data

Manufacturer's Catalog Data shall be submitted in accordance with  
paragraph entitled, "General," of this section.

SD-04 Samples

Samples of detectors used shall be submitted in accordance with paragraph entitled, "Detectors," of this section.

#### SD-07 Certificates

Listing of Product Installations shall be submitted in accordance with paragraph entitled, "Installation," of this section.

#### SD-10 Operation and Maintenance Data

Operation and Maintenance Manual information shall be submitted in accordance with paragraph entitled, "System Description," of this section.

### 1.3 SYSTEM DESCRIPTION

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**NOTE: If Section 16003 GENERAL ELECTRICAL PROVISIONS is not included in the project specification, applicable requirements therefrom should be inserted and the following paragraph deleted.**  
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Section 16003 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

Contractor shall furnish [\_\_\_\_\_] [four] copies of a Operation and Maintenance Manual giving complete instructions for the operation, inspection, testing, and maintenance of the system, including wiring diagrams and equipment malfunction checklist.

#### 1.3.1 Design Requirements

##### 1.3.1.1 Schematics

Schematics shall not be "typicals" but shall show the specific equipment to be furnished.

##### 1.3.1.2 Combustible Gas Environments

System shall provide electrically supervised detection and [\_\_\_\_\_] [noncoded] alarm for combustible gas in Class I, Division 1, Group [\_\_\_\_\_] [C and D] locations. Design shall comply with applicable requirements of NFPA 70, NFPA 72, [and [\_\_\_\_\_] ].

##### 1.3.1.3 Oxygen Deficient Atmospheres

System shall provide electrically supervised detection and [\_\_\_\_\_] [noncoded] alarm of oxygen deficient atmospheres. [Design shall comply with applicable requirements of [\_\_\_\_\_] ].

### 1.3.2 Performance Requirements

Performance shall conform to requirements of [\_\_\_\_\_] [ISA S12.13.01].

Operation of any detection device shall result in control unit relays automatically activating [remote alarms] [, and lights].

## PART 2 PRODUCTS

### 2.1 GENERAL

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**NOTE: Local policies may dictate more elaborate  
procedures for qualification or approval of detector  
samples.**  
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When spot-type detectors are used, the as-built drawings required by Section 16003 GENERAL ELECTRICAL PROVISIONS shall show by number the detectors in the exact sequence in which they are installed in the circuit.

Name of the manufacturer and the serial numbers shall appear on all major components.

Connection Diagrams shall be submitted showing a complete conduit and wiring layout for the equipment to be furnished, including AWG size and type of wire, and number of conductors and connections to the equipment.

As-Built Drawings shall provide current factual information including deviations and amendments to the drawings, and concealed and visible changes in the work.

Manufacturer's Catalog Data shall be submitted for the [combustible gas] [oxygen deficient atmospheres] detection systems including special tools necessary for the maintenance of the equipment. Spare parts data shall be submitted consisting of one set of fuses of each type and size required, and a [\_\_\_\_\_] [hydrogen] gas calibration kit.

Material, Equipment, and Fixture Lists shall include manufacturer's style or catalog numbers, specification and drawing reference numbers, independent testing laboratory reports, and related descriptive matter on the devices to be installed.

### 2.2 ELECTROMAGNETIC COMPATIBILITY

Electrical and electronic systems shall be designed to operate without causing electromagnetic interference to, or malfunctioning due to electromagnetic interference from, other systems or equipment, and shall be in accordance with applicable requirements of [ISA S12.13.01], [\_\_\_\_\_] [, [MIL-STD 461] and [MIL-STD 462].

## 2.3 CONTROL UNIT

### 2.3.1 General Requirements

Control unit shall be [\_\_\_\_\_] [dual] channel, operating over a temperature range of [\_\_\_\_\_] [32 to 125] degrees F [0 to 51] degrees C. Each control unit shall be capable of monitoring [\_\_\_\_\_] [two] detectors.

Control unit shall be housed in a [\_\_\_\_\_] [weatherproof] cabinet suitable for [\_\_\_\_\_] [wall] mounting [in a Class I, Division 1, Group [\_\_\_\_\_] location]. Relays shall be [\_\_\_\_\_] [solid state] [plug-in] type. Rectifiers shall be solid state type.

### 2.3.2 Control Circuits

Circuits shall be solid state, with plug-in type circuit boards, in a housing [conforming to EIA 310-C,] suitable for [Class 1, Group [\_\_\_\_\_] [non-hazardous] locations].

### 2.3.3 Power Supply Component

Transformer, rectifier, resistors, charger, batteries and other required power-supply components shall be incorporated in the control unit, or a separate power-supply unit may be furnished and installed as approved for the application.

### 2.3.4 Indicator Light and Reset

Each control unit shall have [buttons for test, and] indicator lights for Power, [Malfunction,] and Alarm. Indicator lamps shall be color coded as follows: Power (green), [Malfunction [(yellow)] [(\_\_\_\_\_)],] and Alarm [(\_\_\_\_\_) [(red)]]]. Zero, Alarm, and Calibration settings shall be adjustable.

### 2.3.5 Malfunction Circuits

Sensing circuits shall be monitored by individual malfunction circuits. Open circuit shall activate malfunction light and operate relays for [remote] warning signal [and lights].

### 2.3.6 Alarm

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**NOTE: Exercise care to ensure options selected  
properly satisfy project requirements.**  
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Unit shall be arranged to operate alarm relays, activating audible and visible alarms, and continue operation until [[reset by a keyed switch] [silenced by a switch] [in] [on] the unit cabinet] [or] [the atmosphere returns to set conditions].

[Reset key shall not be removable until conditions have returned to normal.] [Cabinet shall be locked by the same key used to reset the alarm]

relays.] [Operation of the silencing switch shall light an indicator lamp, which shall be plainly visible when the cabinet is closed.]

Audible alarm and [\_\_\_\_\_] [red] rotating alarm beacon shall be provided [as indicated].

## 2.4 DETECTORS

If detectors have not been previously qualified and approved for installation, samples of detectors shall be submitted.

### 2.4.1 Circuit Design

Detector circuit design shall be suitable for the types and numbers of detectors, as approved, and detector circuit current shall not exceed ratings of the individual detectors and associated relays.

### 2.4.2 Combustible Gas Detector

Combustible gas detector shall be [\_\_\_\_\_] [diffusion] [sample draw] type [\_\_\_\_\_] [catalytic] sensor [meeting the requirements of ISA S12.13.01,] in a housing suitable for the environment, and shall be intrinsically safe for use in Class I, Division 1, Group [\_\_\_\_\_] locations.

Output signal shall be [\_\_\_\_\_] [4-20 mA]. Operating range shall be [\_\_\_\_\_] [minus 40 to 165] degrees F [minus 40 to 74] degrees C.

### 2.4.3 Oxygen Detector

Oxygen detector shall be [\_\_\_\_\_] [a paramagnetic] [an electrochemical] cell [meeting the requirements of CGA P-14]. Minimum shelf life shall be [\_\_\_\_\_] [6] months.

Output signal shall be [\_\_\_\_\_] [4-20 mA]. Operating range shall be [\_\_\_\_\_] [40 to 90] degrees F [4 to 33] degrees C, [\_\_\_\_\_] [10 to 100] percent relative humidity. Measurement shall be adjustable through a range of [\_\_\_\_\_] [0 to 25] percent oxygen-in-air, and actuation level shall be set at 19.5 percent oxygen.

## 2.5 POWER SUPPLY

Primary power supply shall be a [\_\_\_\_\_] [120]-volt, 60 Hz source. An alternate source of power, arranged to become energized automatically within at least [ten] [\_\_\_\_\_] seconds upon loss of normal power, in accordance with NFPA 110, shall be provided.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Listing of Product Installations for combustible gas detection systems shall include identification of at least 5 units, include identification of at least 5 units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. List shall include



such data as number of false alarms and malfunctions experienced while in service over a period of [\_\_\_\_\_] [2] years.

#### 3.1.1 Combustible Gas Systems

Installation of combustible gas detection and alarm systems shall comply with NFPA 70 and applicable requirements of NFPA 72 [, and [\_\_\_\_\_] ].

#### 3.1.2 Oxygen Deficiency Systems

Installation of oxygen detection and alarm systems shall comply with NFPA 70 [and] [\_\_\_\_\_] .

#### 3.2 GROUNDING

Grounding shall be in accordance with NFPA 70.

#### 3.3 TESTS

Performance tests shall be conducted in accordance with ISA S12.13.01 [\_\_\_\_\_] .

Operation of the entire system shall be tested in operational and alarm modes. Each detector shall be activated by [\_\_\_\_\_] [a hydrogen gas bottle representing the adjusted Lower Flammable Limit (LFL)]. Malfunction feature shall be tested for each control unit.

-- End of Section --